

OBSERVATIONS ON *AMPHORA* SPECIES  
(BACILLARIOPHYCEAE)  
IN THE BRITISH MUSEUM (NATURAL HISTORY)  
IV. Some species from the subgenus *DIPLAMPHORA* Cleve

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**ABSTRACT.** — Three *Amphora* species (*A. crassa* Gregory, *A. graeffeana* Hendey, *A. grevilleana* Gregory) belonging to the subgenus *Diplamphora* Cleve were observed on strewn slides in the British Museum (Natural History). Light microscope photographs of specifically marked specimens or examples corresponding to their descriptions have been included. Comments with regard to the authenticity of the materials examined and the suitability of the observed specimens as types for the species are made.

**RÉSUMÉ.** — Trois espèces d'*Amphora* (*A. crassa* Gregory, *A. graeffeana* Hendey, *A. grevilleana* Gregory) appartenant au sous-genre *Diplamphora* Cleve ont été observées sur des préparations microscopiques du British Museum (Natural History). Des microphotographies des spécimens identifiés en tant qu'espèces ou des descriptions sont jointes. Des commentaires sont faits concernant l'authenticité du matériel examiné et le bien fondé des spécimens observés en tant que types pour les espèces.

**ZUSAMMENFASSUNG.** — Drei *Amphora*-Arten (*A. crassa* Gregory, *A. graeffeana* Hendey, *A. grevilleana* Gregory) aus der Untergattung *Diplamphora* Cleve, wurden in Streupräparaten der Sammlungen des British Museum (Natural History) untersucht. Einbezogen sind Abbildungen von spezifisch markierten Individuen oder von solchen Exemplaren, die mit den Beschreibungen übereinstimmen. Ausserdem werden Kommentare zur Echtheit des geprüften Materials und zur Eignung der untersuchten Individuen als Typus-Exemplaren.

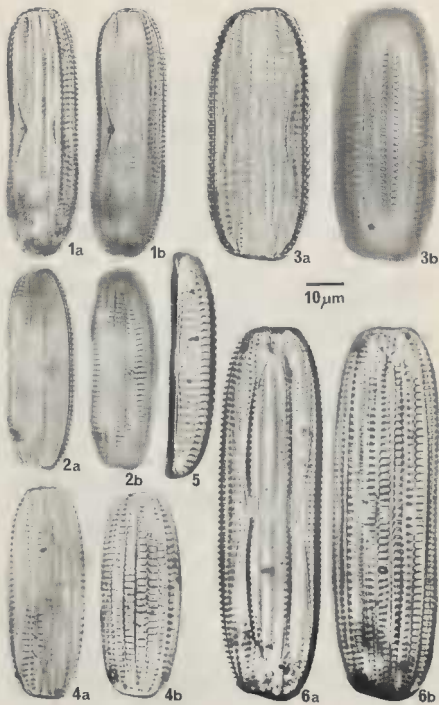
**KEY WORDS :** *Amphora*, Bacillariophyceae, light microscopy, type material.

## INTRODUCTION

This is the fourth in a series of papers (SCHOEMAN & ARCHIBALD, 1985a, 1985b, 1985c) dealing with *Amphora* species of which the type material or type

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slides are to be found mainly in the British Museum (Natural History). These papers report on what an investigator may observe on a particular slide with reference to a specific species, and comment on the authenticity of the specimens examined.

In this paper only *Amphora crassa* Gregory has been recorded from southern Africa, occurring in the marine littoral of the southern and western coasts (GIFFEN, 1970, p. 266; 1975, p. 73; 1976, p. 381). The other two species were studied as a result of the complexities surrounding the taxonomy of *Amphora graeffii* Grunow (cf. SCHMIDT, 1874-1959, pl. 25, fig. 40), which is listed from Saldanha Bay on the west coast of South Africa (GIFFEN, 1976, p. 382, fig. 6). Since GIFFEN's illustration (op. cit.) introduced a suspicion that his identification was not quite accurate, we also examined *Amphora grevilleana* Gregory, which CLEVE (1895, p. 113) equated with *A. graeffii* as depicted by GRUNOW (vide SCHMIDT, op. cit.), and *Amphora graeffeana* Hendey, which is the new name given to CLEVE's concept of *A. graeffii*.

More detailed comments on these three taxa are made in the text, but these should not be regarded as the last word in their taxonomy.

## MATERIALS

The diatom slides examined in this study are listed separately under the species dealt with. With the exception of the two HENDEY slides, all other slides are found in the collections of GREVILLE, PAYNE and TEMPÈRE & PERAGALLO (2nd Edition), housed in the British Museum (Natural History). The HENDEY slides (Nos. 6497, 6968) were obtained on loan from the HENDEY Collection (St Agnes, Cornwall) and examined in the British Museum (Nat. Hist.). The abbreviation BM, preceding a slide number, indicates a slide from the collections of the British Museum (Nat. Hist.).

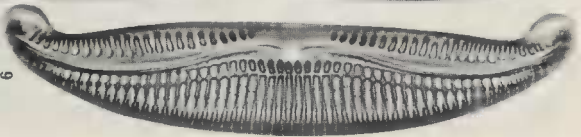
## OBSERVATIONS AND DISCUSSION

### AMPHORA CRASSA GREGORY

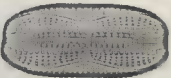
GREGORY, 1857a, p. 72, pl. 1, fig. 35 (?).

GREGORY, 1857b, p. 524, pl. 14, figs. 94, 94b-d.

Plate 1. — Figs. 1-6 : *Amphora crassa* Gregory. Figs. 1a, b : BM 958. Glenshira. Ringed frustule (lectotype) at different levels of focus. Figs. 2a, b : BM 958. Glenshira. Another ringed frustule at two levels of focus. Figs. 2a - ventral view; Fig. 2b - dorsal view. Figs. 3a, b : BM 1341. Lamlash, Arran. Ringed frustule at two levels of focus. Fig. 3a - ventral view; Fig. 3b - dorsal view. Figs. 4a, b : BM 1193. Lamlash, Arran. Ringed frustule at different levels of focus. Fig. 4a - ventral view; Fig. 4b - dorsal view. Fig. 5 : BM 1255. Arran. Ringed valve, showing valve face and dorsal mantle. Figs. 6a, b : BM 1192. Brodick Bay, Arran. Ringed frustule at different levels of focus. Fig. 6a - ventral view; Fig. 6b - dorsal view. — Fig. 1-6 : bright field illumination (B.F. Illum.).



10µm



PERAGALLO & PERAGALLO 1897-1908, p. 208, pl. 46, fig. 5.  
HENDEY 1964, p. 262.

#### Slides examined :

- BM 955 «Glenshirra», Gregory C. 10. Coll. Greville. Ring No. 4.  
BM 958 «Glenshirra», Gregory. Coll. Greville. Ring Nos. 1 (Figure 1), 2 and 3 (Figure 2).  
BM 1192 Brodick Bay, Arran. Gregory 1857. Coll. Greville. Ring No. 3 (Figure 6).  
BM 1193 Lamlash, Arran. Gregory 1857. Coll. Greville. Ring Nos. 1 (Figure 4) and 3.  
BM 1196 Arran, Gregory 1857. Coll. Greville. Ring No. 6.  
BM 1255 Arran, Gregory 1857. Coll. Greville. Ring No. 3 (Figure 5).  
BM 1341 Lamlash, Arran 1857, Gregory. Coll. Greville. Ring No. 8 (Figure 3).  
BM 38612 Stomach of Holothurian, Alexandria. Coll. F.W. Payne (Figures 11-14).  
BM 38615 Stomach of Holothurian, Alexandria. Coll. F.W. Payne. (Figure 10).  
BM 38618 Porto Seguro, Brazil, Coll. F.W. Payne. (Figures 8, 9).  
Hendey 6968 Bryher (Isles of Scilly). Coll. Hendey. EF M40 (Figure 7).

#### Notes :

This species was originally described by GREGORY (1857a) from the diatomaceous sand of Glenshirra. In a subsequent paper (GREGORY, 1857b) he amplified the description and figured «the true *A. crassa*» from Lamlash Bay stating that the figure given in his original description (GREGORY, 1857a) «is not, at all events, the usual form. . . . and it may possibly represent a different species». There are two slides of the Glenshirra material, BM 995 and BM 958, bearing ringed examples of *A. crassa*, from which the lectotype slide can be chosen. The specimen on slide BM 995 (Ring No. 4) is a poor example, and therefore we have selected the second slide, BM 958, with three ringed frustules as the lectotype slide. The morphological details of these frustules (Figures 1, 2) correspond with GREGORY's (1857a, 1857b) two descriptions, but it seems evident that he did not observe clearly the structure of the transapical striae of the valves. These are coarsely punctate, and are not similar to the girdle striae. Despite this, we accept these examples as the true *A. crassa*.

We then examined two slides (BM 1341 and BM 1193) prepared from GREGORY's material collected in Lamlash Bay, where he found the species more frequently. A ringed frustule from each of these two slides is illustrated in Figures 3 and 4 respectively. Both examples correspond closely with GREGO-

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Plate 2. — Figs. 7a-c : *Amphora crassa* Gregory. Hendey 6968. Bryher, Isles of Scilly. Same valve under different forms of illumination and at various levels of focus. Figs. 8, 9 : «*Amphora crassa* Gregory» sensu F.W. Payne. BM 38618. Porto Seguro, Brazil. Figs. 10-14 : *Amphora crassa* Gregory var. *punctata* Grunow (= *A. crassa* Gregory). Fig. 10 : BM 38615. Stomach of Holothurian, Alexandria. Frustule, ventral view. Figs. 11-14 : BM 38612. Stomach of Holothurian, Alexandria. Various valves. — Figs. 7a, 8-13 : B.F. illum. Fig. 7b : oblique bright field illumination (O.B.F. illum). Fig. 7c, 14 : phase contrast illumination (P.C. illum.).

RY's (1857b) later description, and are identical to the specimens on the lectotype slide.

Three additional slides from Arran, the same general environment in which lies Lamlash Bay, were also examined. Two of these (slides BM 1196, BM 1255) are not further qualified with a reference to a specific locality, while the third (BM 1192) comes from Brodick Bay. The specimen in Ring No. 6 on slide BM 1196 is poor and of little diagnostic use. On the other hand, the example on slide BM 1255 in Ring No. 3 (Figure 5) shows a valve in more or less the same aspect as that illustrated by GREGORY (1857b) in figure 94c of his plate 14. This example demonstrates a valve turned towards the dorsal mantle and illustrates more clearly a longitudinal line (costa ?) dividing the valve face from the dorsal mantle. Figure 6 depicts a much larger example from Brodick Bay (Slide BM 1192 Ring No. 3) having the same structural characteristics as the lectotype.

To obtain a more modern concept of *A. crassa*, a slide from the HENDEY collection (Hendey 6968) was borrowed by the senior author and examined in the British Museum. HENDEY personally indicated the specimen (Figure 7) illustrated here, which has been marked with an England Finder (EF) co-ordinate as shown above. This example clearly shows the typical characteristics of *A. crassa*. The punctate nature of both the dorsal and ventral striae is very evident in this specimen (Figures 7a and 7b), while a phase contrast view (Figure 7c) demonstrates the dorsal longitudinal line as seen in Figure 5, but in a different plane of viewing. Another feature plainly seen in Figure 7c is a ventral longitudinal line interrupting the striae near the ventral margin. This ventral costa (?) has not been mentioned in the earlier descriptions (GREGORY, 1857b; PERAGALLO & PERAGALLO, 1897-1908) nor in HENDEY's (1964, p. 262) more recent circumscription. As this structure is also clearly visible in examples from Glenshira and Lamlash Bay on slides BM 958 (Figure 2a), and BM 1193 (Figure 4a) respectively it would appear to be a diagnostic character, which should be noted in future descriptions of the species.

The F.W. PAYNE collection of the British Museum (Natural History) contains a slide (BM 38618) from Porto Seguro in Brazil, on which the only identification given is *A. crassa*. A mere glance at the size, valve shape and striae structure of the specimens observed here (Figures 8, 9) is sufficient to show a case of complete misidentification. We have however, not been able to identify this taxon yet, but believe it to be akin to *Amphora egregia* Ehrenberg.

Finally, two further slides in the F.W. PAYNE collection are labelled as containing *A. crassa* var. *punctata* Grunow. A frustule on slide BM 38615 (Figure 10) and valves from slide BM 38612 (Figures 11-14) have been illustrated. Apart from the very distinctly punctate striae, there seems little to differentiate these examples from the lectotype (Figures 1, 2) or the other specimens in Figures 3-7. Figure 14 shows particularly clearly the interruption of the ventral striae by a ventral longitudinal line (costa ?) as described above in the HENDEY specimen (Figure 7c). We therefore support VANLANDINGHAM (1967, p. 207) in accepting the var. *punctata* as synonymous with *A. crassa*.

**Dimensions of specimens examined :**

Length 45.0-98.0  $\mu\text{m}$ ; breadth of frustule 17.5-28.0  $\mu\text{m}$ ; breadth of valve 8.0-12.0  $\mu\text{m}$ ; dorsal striae at the centre 6-8 in 10  $\mu\text{m}$ , near the centre 5-8 in 10  $\mu\text{m}$  and at the poles 6-9 in 10  $\mu\text{m}$ ; ventral striae near the centre 5-8 in 10  $\mu\text{m}$ ; striae on the girdle bands 5-7 in 10  $\mu\text{m}$ .

**AMPHORA GRAEFFEANA HENDEY**

HENDEY, 1973, p. 317, figs 12-19.

**Slides examined :**

Hendey 6497 Porthleven, Cornwall, Coll. Hendey. (Figures 15-19).

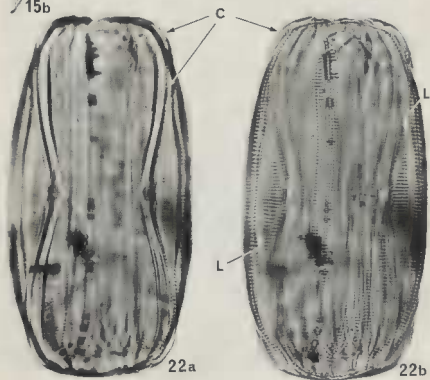
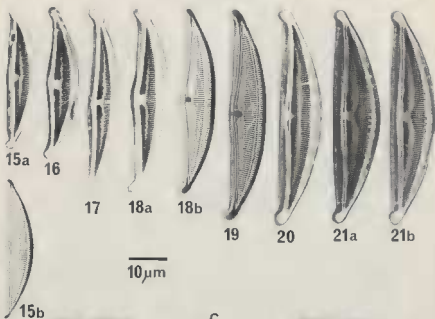
BM 68466 Port Townsend Washington, U.S.A. Coll. Tempère & Peragallo (2nd Ed.) slide No. 120 (Figures 20, 21).

**Notes :**

*Amphora graeffii* Grunow (ex SCHMIDT, 1874-1959, pl. 25, fig. 42) has been recorded from the marine littoral of South Africa at Saldanha Bay (GIFFEN, 1976 p. 382, fig. 6). There is some doubt about this identification, and the complications surrounding the true identity of *A. graeffii* makes it difficult to assess its accuracy. Although detailed taxonomic studies are beyond the scope of this series of papers, some background information in this case is required to explain why we examined the two slides mentioned above.

*Amphora graeffii* has no formal written diagnosis, but its identity is based on an 1875 drawing by GRUNOW in SCHMIDT's atlas (SCHMIDT, 1874-1959, pl. 25, fig. 42). CLEVE (1895, p. 113), however, considered this specimen to be *A. grevilleana* Gregory (see below), while he accepted GRUNOW's *A. graeffii* var. (vide SCHMIDT *op. cit.*, pl. 25, fig. 40) as the true *A. graeffii*. HENDEY (1973, p. 317) agreed with CLEVE, but felt it necessary to rename CLEVE's concept of *A. graeffii*, as it differed from the original GRUNOW drawing bearing that name. Consequently, having examined numerous specimens from Porthleven agreeing with CLEVE's description, HENDEY renamed it *Amphora graeffeana*. We have examined a number of examples from HENDEY's Porthleven slide (Hendey 6497). These specimens (Figures 15-19) agree very closely with GRUNOW's drawing of *A. graeffii* var. (SCHMIDT, 1874-1959, pl. 25, fig. 40; vide GRUNOW drawing collection, Naturhistorisches Museum, Vienna, Bilder-Sammlung No. 3030) in shape of valve and the distinct longitudinal line cutting across the dorsal transapical striae near the dorsal margin (Figures 15b, 18b, 19). The Porthleven examples differed from it only in the shape of the axial area, which is relatively wider and often becomes constricted to varying degrees at the centre of the valve by the lengthening of the central dorsal striae (Figures 17, 18). It should also be noted that when ventral striae are visible, these are restricted to the valve apices (Figures 18b, 19).

PERAGALLO & PERAGALLO (1897-1908, p. 211, pl. 46, fig. 20; pl. 47, fig. 4) also appear to have accepted CLEVE's (1895) ideas, but illustrate two





different forms as their concept of the true *A. graeffii*. The first of these (pl. 46, fig. 20) is something different to the Porthleven examples, but the second form (pl. 47, fig. 4) is remarkably similar to HENDEY's specimens (Figures 15-19). At the same time PERAGALLO & PERAGALLO (1897-1908, p. 211, pl. 46, fig. 14, 15) described and illustrated a yet smaller form, *A. graeffii* var. *minor*. We therefore examined slide BM 68466 (= Tempère & Peragallo slide No. 120) observing several examples of this variety (Figures 20, 21). These appeared to be almost identical with HENDEY's specimens from Porthleven; the only difference being a row of irregularly spaced flecks along the dorsal margin. These flecks arise apparently from local interruptions of the dorsal mantle striae. In these specimens restriction of ventral striae to the valve apices is clearly evident (see figures 20, 21).

To add further to the confusion surrounding the identity of *A. graeffii*, HENDEY (1964, p. 263, pl. 37, fig. 8) depicts yet another form under the name *A. graeffii* var. *minor*. This specimen lacks the wide axial area characteristic of both the Porthleven examples (Figures 15-19) and the var. *minor* on slide BM 68466 (Figures 20, 21), and also has ventral striae interrupted only at the central nodule instead of being restricted to the apical region. The latter feature agrees, however, more closely with GRUNOW's drawing of *A. graeffii* var. (SCHMIDT, 1874-1959, pl. 25, fig. 40). In a later paper HENDEY (1970, p. 154, pl. 3, fig. 31) used the same specimen (cf. HENDEY, 1964, pl. 37, fig. 8) to illustrate «*Amphora graeffii* (Grunow) Cleve» (*sic*) from Kuwait, though he did remark that the Kuwaiti examples correspond more closely to the var. *minor*.

It is evident from the remarks above that further careful study is required to resolve the taxonomy of *A. graeffii* and the taxa closely associated with it. Whether CLEVE's (1895) description really relates to the Porthleven examples or to the form found along the Welsh coast (HENDEY, 1964) or in Kuwait (HENDEY, 1970) is a matter for more intensive investigation than can be given to it here.

#### Dimensions of specimens examined :

Henley 6497 : Length 37.0-55.0  $\mu\text{m}$ ; breadth of valve 8.0-10.5  $\mu\text{m}$ ; dorsal striae near the centre 18-26 in 10  $\mu\text{m}$ .

BM 68466 : Length 56.5-68.5  $\mu\text{m}$ ; breadth of valve 10.0-14.0  $\mu\text{m}$ ; dorsal striae at and near the centre 18-22 in 10  $\mu\text{m}$ , and at the poles 19-22 in 10  $\mu\text{m}$ ; ventral striae near the poles only, 17-20 in 10  $\mu\text{m}$ .

Plate 3. — Figs. 15-19: *Amphora graeffeana* Hendey. Hendey 6497. Porthleven, Cornwall. Figs. 15a, b: same valve, different illumination. Figs. 18a, b: same valve, different illumination. Figs. 20, 21 : *Amphora graeffii* Grunow var. *minor* Peragallo & Peragallo. BM 68466. Port Townsend U.S.A. Figs. 21a, b : same valve at different levels of focus. Figs. 22a, b: *Amphora grevilleana* Gregory. BM 960. Gienishira, Scotland. Ringed frustule at different levels of focus. Note conopeum (C) and longitudinal line (L). — Figs. 15a, 16-18a, 20-21b : P.C. illum. Figs. 15b, 18b, 19, 22a, b : B.F. illum.

**AMPHORA GREVILLEANA GREGORY**

GREGORY, 1857a, p. 73, pl. 1, fig. 36\*.

GREGORY, 1857b, p. 522, pl. 13, fig. 89.

HENDEY, 1964, p. 263, pl. 38, fig. 6.

**Slides examined :**

BM 960 Glenshira, Gregory. Coll. Greville. Ring Nos. 1 (Figure 22), 2 (Figure 23), 3 (Figure 24), 4.

BM 68466 Tamatave, Madagascar. Coll. Tempère & Peragallo (2nd Ed.) slide no 100.

**Notes :**

*A. grevilleana* was originally described by GREGORY (1857a) from the diatomaceous sand deposit at Glenshira, Scotland. In a subsequent publication, however, he (GREGORY, 1857b) stated that the frustule illustrated in the original description actually belongs to another species, which he called *Amphora fasciata* Gregory. To correct this mistake, a new drawing by GREVILLE (cf. GREGORY, 1857b, pl. 13, fig. 89) was produced to illustrate the frustule of the true *A. grevilleana*. At the same time GREGORY (1857b, p. 522) expanded the description of the species.

We examined one slide prepared from the Glenshira diatomaceous sand (BM 960). This slide had five rings marked as containing *A. grevilleana*. Rings 1-4 encircled specimens that did agree with the description of *A. grevilleana*, but ring No. 7 contained a form which was dubious. We have therefore ignored the latter, and have illustrated three of the remaining ringed specimens (Figures 22-24). None of these are particularly good, but they do show reasonably clearly the characteristic features of the species. The specimen (Figure 22) in Ring No. 1 was the clearest, and we have therefore illustrated it at different depths of focus. The frustules are broadly oval to linear with broadly rounded, somewhat truncate apices. The girdle bands are clearly striate, and on the ventral side, at least, are separated from each other by a narrow structureless band (Figures 22b, c), which agrees with GREGORY's (1857a) description. The striae on the dorsal girdle bands consist either of a single row of pores, or a double row of pores arranged alternately or an intermediate arrangement where the pores form a single zigzagging line. The valve is broadly linear, with a convex dorsal margin and a more or less straight to slightly convex ventral margin. The poles are broad, somewhat rostrate and turned to the ventral side. The arcuate raphe branches lie in a relatively broad axial costa extended on the dorsal side into a conopeum (C) which can be seen reasonably well in Figure 22 and particularly at the poles, where it appears to be expanded somewhat. The central pores are weakly deflected to the dorsal side. The dorsal striae are interrupted by a longitudinal line (L: Figure 22b) running fairly close to the dorsal margin. Towards the centre of the valve this line expands slightly and arches flatly more to the dorsal side of the valve.

With reference to striae structure, both GREGORY's descriptions state that the striae are moniliform, implying a single row of pores. A similar impression

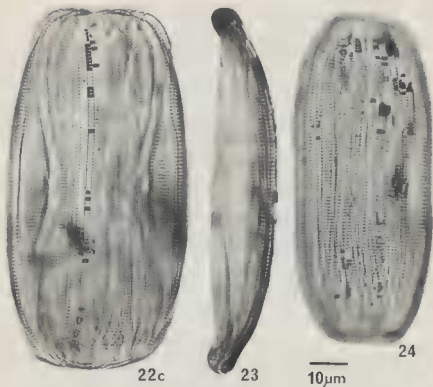


Plate 4. - Figs. 22c-24 : *Amphora grevilleana* Gregory. BM 960. Glenshira, Scotland. Ringed examples. Fig. 22c : same frustule as illustrated in Figures 22a and 22b, but at a different level of focus. Fig. 23 : single valve of a frustule (the complete frustule not shown here). Note raphe and dorsal longitudinal line. Fig. 24 : frustule in dorsal view, showing dorsal mantles and associated girdle bands. - Figs. 22c-24 : B.F. Illum.

is gained from CLEVE (1895, p. 113) and HENDEY (1964, p. 263), who describe the striae as being «coarsely punctate» and «punctate» respectively. On the other hand several illustrations of *A. grevilleana* in the literature (e. g. HENDEY, 1973, p. 317, fig. 20) depict a double row of alternating pores. In the specimens illustrated here in Figures 22 and 23 the striae structure is not very clear, but we gained the impression that they consist of a double row of pores arranged in quincunx. However, since the structure of the striae on the valve is sometimes very similar to the striae structure on the girdle bands (see above), it is possible that the valvar striae might also consist of a single row of pores.

Another point needing further clarification is the presence or absence of ventral striae. None of the descriptions or illustrations of *A. grevilleana*, that

we have studied, mention the presence of ventral striae. However, in Figure 22c, striae with a structure similar to the dorsal striae are plainly evident on the ventral side of the valve. These fall short of the raphe leaving a hyaline band between the ventral striae and the raphe. This band appears to be at a slightly different level suggesting that it may be thickened or may represent a fold in the valve surface. In contrast, Figure 23 shows a specimen in which there is no indication of ventral striae, but this may be due to the angle at which the frustule is lying (Figure 23 represents only one valve of this frustule). On the other marked specimens on slide BM 960 (Ring Nos 3 and 4) ventral striae were also not visible. In this respect, HENDEY (1964, p. 263, pl. 38, fig. 6) illustrated an example having no visible ventral striae, which corresponds very closely to our Figure 23.

Finally, we examined one other slide on which the presence of *A. grevilleana* was indicated. This was slide BM 68466 (Tempère & Peragallo, 2nd Ed., slide No. 100) prepared from material collected at Tamatave, Madagascar. Despite being listed as present on this slide (TEMPERE & PERAGALLO, 1907-15, p. 52) we found no examples on it.

#### Dimensions of specimens examined

Length 85.0-104.5  $\mu\text{m}$ ; breadth of frustule 36.0-48.5  $\mu\text{m}$ ; striae near the centre 10-11 in 10  $\mu\text{m}$ ; striae on the girdle bands 12-13 in 10  $\mu\text{m}$ .

#### ACKNOWLEDGEMENTS

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